Lastly, it is often remarked (1) that the immediate offspring of different races or even varieties resemble their parents equally, but (2) that great diversities appear in the next and in succeeding generations. In which stage does the variability occur? It cannot be in the first (class representation) nor in the second (development), else (1) could not have been true; therefore it must be in the third stage. A white parent necessarily contributes white elements to the structureless stage of his offspring, and a black, black; but it does not in the least follow that the contributions from a true mulatto must be truly mulatto.

One result of this investigation is to show very clearly that large variation in individuals from their parents is not incompatible with the strict doctrine of heredity, but is a consequence of it wherever the breed is impure. I am desirous of applying these considerations to the intellectual and moral gifts of the human race, which is more mongrelized than that of any other domesticated animal. It has been thought by some that the fact of children frequently showing marked individual variation in ability from that of their parents is a proof that intellectual and moral gifts are not strictly transmitted by inheritance. My arguments lead to exactly the opposite result. I show that their great individual variation is a necessity under present conditions; and I maintain that results derived from large averages are all that can be required, and all we could expect to obtain, to prove that intellectual and moral gifts are as strictly matters of inheritance as any purely physical qualities.

III. "Further Experiments on the Effect of Alcohol and Exercise on the Elimination of Nitrogen and on the Pulse and Temperature of the Body." By E. A. Parkes, M.D., F.R.S. Received April 25, 1872.

In the 'Proceedings of the Royal Society' (xviii. p. 362, xix. p. 73) are some observations by the late Count Wollowicz and myself on the effect of alcohol, brandy, and claret on the elimination of nitrogen. As the experiments were on one man, I have taken an opportunity of repeating them on another person; and as the late observations of Dr. Austin Flint (junior) on a man who walked 317 miles in five days have appeared to some persons to run counter to the now generally accepted view that exercise produces either no change or only insignificant changes in the urea, I have combined experiments on exercise with those on alcohol. With respect, however, to Dr. Austin Flint's experiments, it would appear that while the egress of nitrogen was determined with the greatest accuracy, the amount taken in was for the most part merely estimated by reference to Payen's Tables, and therefore there is no certainty that the ingress was what it is assumed to have been. The food also was very

varied, so that the difficulty of properly estimating the nitrogen was still more increased.

The following experiments were made on a soldier, W. D., aged 30. He is a powerfully built man, 5 feet 6 inches in height, and measuring 40 inches round the chest. As a young man, he had been employed in a distillery near Glasgow, and at that time drank largely of whisky, sometimes taking half a pint before breakfast. For the last ten years, since he has been in the army, he has been very temperate, taking chiefly beer in moderate quantities, and only occasionally spirits. He bears the character of a very steady soldier, and has always had perfect health, with the exception of an attack of "spotted typhus" six years ago. He has never served abroad.

As he is a Scotchman and had been brought up on oatmeal and milk, I placed him on a diet entirely composed of these two substances; and after a preliminary trial to see how much he required, he received every day 28 ounces of Scotch oatmeal and two pints of milk, the whole of which he took at regular hours. The oatmeal was all purchased at the same time and was well mixed, so that he received daily precisely the same amount of nitrogen. It would be impossible to keep the ingress of nitrogen more uniform than was done in this case. The milk was very good in quality; but to ensure, as far as possible, that it should be of equal nutritive value every day, water was added until its specific gravity, which was usually 1·032, was reduced to 1·028. He drank only water except on the days when brandy was added, and, with the exception of salt, took no other solid food for sixteen days except the oatmeal and milk. The daily amount of water (including that in the milk) was 135 fluid ounces; but some was lost in cooking the oatmeal. He was perfectly well and vigorous on this food, and his weight remained unchanged.

The oatmeal, burnt with soda-lime, was found to contain 2·023 per cent. of nitrogen; and the milk contained from ·35 to ·37 per cent. of nitrogen, and is taken at a mean of ·36. In the milk and the oatmeal together he received daily 20 grammes, or 308·6 grains, of nitrogen. The brandy contained 45 volumes per cent. of alcohol.

The course of experiment was as follows:—

For six days he remained quiet, taking only slow walking exercise to keep him in health; for three days he then worked hard at digging ground from eight to nine hours daily. It was intended that he should march thirty miles daily in heavy marching order; but after marching for eight miles he became footsore, and I was obliged to change his work to digging. He worked as hard as he could and felt fatigued in all his muscles, but it was impossible to calculate the exact amount of work: as far as could be done, he made it as uniform as he could from day to day.

After three days' exercise he was kept at rest for three days, and then resumed exercise of the same kind for three days, taking, however, during

the second period 12 fluid ounces of brandy (containing 5·4 fluid ounces of absolute alcohol) daily in three doses of 4 ounces each at 10, 2, and 6 o'clock.

After this he rested again, but being required for other duty there were only two days' observations during this last period.

1. *Weight of Body in kilogrammes.*

The weight was taken at 8 A.M., before breakfast and after the bladder was emptied. The machine was a new German balance, extremely delicate and turning distinctly with 1 gramme (15·43 grains).

First period. Comparative rest.		Second period. Exercise on water.		Third period. Rest.		Fourth period. Exercise on brandy.		Fifth period. Rest.	
Date.	Weight.	Date.	Weight.	Date.	Weight.	Date.	Weight.	Date.	Weight.
March		March		March		March		March	
12.	66·420	20.	66·980	23.	66·54	26.	66·380	29.	66·19
13.	67·101	21.	66·420	24.	66·31	27.	66·360	30.	65·49
14.	66·631	22.	66·260	25.	66·15	28.	66·300		
15.	67·021								
16.	67·091								
17.	66·300								
18.	66·600								
19.	66·880								
Mean	66·68	.....	66·553	.....	66·333	.....	66·346	.... .	65·84

The weight was very uniform during almost the whole time; but it is plain he lost a little weight during the first exercise-period, and continued afterwards to lose it. The change was, however, inconsiderable, as there was a loss of only 2 lbs. in weight during the whole period.

2. *Elimination of Nitrogen.*

The nitrogen in the urine and fæces was determined every day by burning with soda-lime. The urine was collected from 8 A.M. to 8 A.M. The weights are given in grammes.

First Period.			
Date.	Nitrogen in urine.	Nitrogen in fæces.	Total by the two outlets.
March.			
13 to 14.	15·195	3·195	18·390
14 to 15.	15·307	4·199	19·506
15 to 16.	14·812	4·519	19·331
16 to 17.	14·878	4·207	19·085
17 to 18.	14·693	3·275	17·968
18 to 19.	16·314	3·194	19·508
Mean.....	15·183	3·765	18·948
Second Period. Exercise on Water.			
19 to 20.	15·861	4·153	20·014
20 to 21.	16·367	5·182	21·549
21 to 22.	16·593	5·609	22·202
Mean.....	16·274	4·981	21·255
Third Period. Rest.			
22 to 23.	15·504	4·026	19·530
23 to 24.	16·570	3·476	20·046
24 to 25.	15·487	2·250	17·737
Mean.....	15·850	3·251	19·101
Fourth Period. Exercise on Brandy.			
25 to 26.	14·644	5·075	19·719
26 to 27.	15·484	4·250	19·734
27 to 28.	17·122	3·790	20·910
Mean.....	15·750	4·372	20·121
Fifth Period. Rest.			
28 to 29.	15·007	3·215	18·212
29 to 30.	?	2·977	

During the sixteen days 19·59 grammes of nitrogen were discharged by the urine and bowels every day. The daily entrance of nitrogen during the same period was 20 grms., viz. 16 grms. in the oatmeal and 4 grms. in the milk.

To estimate the effect of exercise and alcohol on the elimination of nitrogen, the urinary and the alvine exits must be separately considered.

The mean daily discharge of the urinary nitrogen of the sixteen days is 15·6 grms. If the mean amounts of the different periods are looked at, it will be seen how little they deviate from the mean. There is, however, in

both the exercise periods a slight excess over the first period, amounting to 1 and ·5 grm. respectively. The differences are so slight that they might be disregarded, only the recurrence in the two exercise periods seems to show that the slight excess is not accidental.

The observations support the facts noted in the papers already communicated to the Royal Society, viz. that there is a slight excess of nitrogen in a mixed exercise and rest period over a period of entire rest, owing, it would appear from the former experiments in the rest period, to a slight increase in elimination *after* exercise.

The brandy had no effect on the elimination of nitrogen, for the mean of the two periods of exercise only differs by 0·5 grm., and the results are practically identical. And as a further proof that the brandy had no effect in either direction, it may be noticed that both the highest and lowest daily excretion occurred in the brandy period.

With regard to the alvine nitrogen, the elimination was increased during the exercise periods, the mean of the whole sixteen days being 3·976 grms.; it was 4·981 grms. and 4·372 grms. in the two exercise periods. This depended on the effect of the particular kind of exercise (digging) on the action of the abdominal muscles and on the bowels, as will be seen from the next Table, if the following point is taken into account. In the first period there was a loose alvine discharge during four or five days, arising apparently from the use of the oatmeal in a man who had lately been accustomed to other food. Under the microscope the envelopes of the oat and of barley or wheat which had been mixed with it were seen in quantities in the fæces; therefore in this period the large amount of solids and the smaller amount of nitrogen were given by considerable portions of undigested oatmeal passing out; in later periods the proper excreta of the intestines were probably in larger amount.

Mean daily Alvine Excreta, in grammes.

	First period. Rest.	Second period. Exercise on water.	Third period. Rest.	Fourth period. Exercise on brandy.	Fifth period. Rest.
Daily weight of the excreta	364	371	301	519	306
Percentage of solids in do.	21·08	20·9	21·5	22·1	22·2
„ water in do.	78·92	79·1	78·5	77·9	77·8
Daily weight of solids of excreta	76·73	77·54	64·7	110·5	67·9
Daily amount of alvine water	287·27	293·46*	236·3	408·5	238·1

* Adopting 294 cub. centims. of water as the daily alvine discharge, there passed daily by the bowels 10·35 fluid ounces, and by the urine 71 fluid ounces of water from this man, or 1 to 7 nearly. The amount is much more than in meat-eaters. As he took about 130 fluid ounces of water daily, about 49 fluid ounces must have passed off by the skin and lungs.

If we adopt the two last rest periods, which are nearly alike, as the standard of the usual alvine excreta under this diet, the muscular work (digging), by acting mechanically on the bowels, caused a greater discharge both of the solid parts of the excreta and of water; much of the difference of the nitrogen, and perhaps the whole, is thus accounted for.

It was very remarkable how uniform the excreta were in the percentage of water when the means of the periods are taken, though from day to day there was considerable variation. It will be seen how much larger the excreta were than is usual in meat-eaters, and how much nitrogen passed from the bowels.

3. *The amount of Urinary Water, Chlorine, Phosphoric Acid, and free Acidity.*

To save space I give only the means of the periods.

Daily Excretion, in grammes, by the Urine.

	First period. Rest.	Second period. Exercise on water.	Third period. Rest.	Fourth period. Exercise on brandy.	Fifth period. Rest.
Water of urine (in cub. centims.)	2016	1823	2140	2006	2086
Chlorine	1·911	1·890	2·016	1·775	2·058
Phosphoric acid	2·857	2·875	2·731	2·935	2·576
Free acidity (taken as crystallized oxalic acid)	2·953	2·759	2·678	3·008	2·690

The phosphoric acid was not affected in the first exercise period; it was slightly increased in the alcoholic, but the difference may be too slight to be material. The chlorine was rather lessened in both exercise periods: the free acidity was slightly increased in the brandy period over the exercise period on water; but the change was so slight as to be within the range of daily variation. Exercise on water exerted no marked influence on the free acidity as compared with the periods before and after.

4. *The Pulse* *.

The pulse was taken every two hours after the man had been in a recumbent position for at least fifteen minutes.

* The pulse and temperatures were taken with very great care by Serjeant Turner of the Army Hospital Corps.

Date. March.	Hours. 6 A.M.	8 A.M.	10 A.M.	12 P.M.	2 P.M.	4 P.M.	6 P.M.	8 P.M.	10 P.M.	Mean of day.
Before exercise.										
13.	61	61	71	52	67	62	62	61	60	61·9
14.	61	64	66	53	68	64	62	64	55	61·9
15.	55	56	67	54	60	66	73	60	62	61·4
16.	60	52	72	60	69	72	70	70	60	65·0
17.	56	60	66	61	64	64	66	60	56	61·4
18.	54	60	68	60	64	72	64	60	57	62·8
Mean of hours.	57·5	58·8	68·3	56·6	65·3	66·6	66·1	62·5	58·3	62·2
Exercise on Water.										
19.	58	54	72	92	80	72	68	64	63	69·8
20.	60	60	59	67	66	67	76	67	56	64·2
21.	66	60	69	64	66	62	58	68	60	63·6
Mean of hours.	61·3	58·0	66·6	74·3	70·6	67·0	67·3	66·3	59·2	65·8
After exercise on Water.										
22.	57	74	62	60	68	66	72	68	59	65·1
23.	62	60	64	60	62	70	62	64	61	62·7
24.	68	60	66	62	62	58	63	70	58	63·0
Mean of hours.	62·3	64·6	64·0	60·6	64·0	64·6	65·6	67·3	59·3	63·6
Exercise on Alcohol.										
25	59	62	66	70	78	79	74	82	64	70·44
26	64	66	76	72	73	68	76	74	68	70·8
27	65	68	68	58	72	79	78	72	68	69·8
Mean of hours.	62·6	65·3	70·0	66·6	74·3	75·3	76·0	76·0	66·6	70·35
After exercise on Alcohol.										
28	68	68	70	62	59	62	59	57	50	61
29	60	56	62	57	66	59	61	57	62	60
30	60	61	..	...	...	...	...	...	...	...
Mean of hours.	62·6	61·6	66·0	59·5	62·5	60·5	60·5	57·0	56·0	60·5

The pulse was very regular in the man, and was strong and slow. The mean of the first six days gave 62·2 beats per minute. Exercise on water

raised the mean daily beats from 62·2 to 65·8. In the next rest period the mean daily pulse sank to 63·6, but rose in the exercise and brandy period to 70·35. The effect of the brandy was therefore to cause a daily increase of 6552 pulsations of the heart over the exercise period with water, and an excess of 11304 pulsations over the first rest period. The effect of the brandy is seen at once in comparing the hours 2, 4, 6, 8, and 10 P.M. in the two exercise periods.

Mean pulse.

	2 P.M.	4 P.M.	6 P.M.	8 P.M.	10 P.M.
Exercise on water.....	70·6	67·	67·3	66·3	59·2
Exercise on brandy ...	74·3	75·3	76	76	66·6

At 12 o'clock the same fact would have been noted, but that on the first exercise day the pulse was greatly augmented (to 92 per minute or 50 per cent.) by marching eight miles in heavy marching order from 10 to 12 o'clock. There is hardly any form of exercise which augments the pulse like quick movements, especially when weights are carried. In the second period the corresponding exercise was digging, which increases the pulse much less. Again, on the third day of the brandy period, he did no work from 11 to 12 o'clock, as it was raining; and consequently at 12 o'clock on that day his pulse, which in the two previous days was 70 and 72, was only 58. These two facts explain the only exception in the Tables to the rule of the excess of heart-beats, under the influence of alcohol, at every hour. The effect on the heart was also made evident in a way presently to be noticed.

5. *The Temperature of the Body.*

Axilla temperature (the thermometer was inserted for 20 minutes).

Before exercise.

Date. March.	Hours.									Mean of day.
	6 A.M.	8 A.M.	10 A.M.	12 P.M.	2 P.M.	4 P.M.	6 P.M.	8 P.M.	10 P.M.	
13.	97·4	97·2	96·5	97·8	97·4	98·4	98·4	97·8	97·4	97·6
14.	97·0	97·8	98·2	97·8	98·2	98·3	98·4	98·0	98·8	98·0
15.	97·5	97·6	98·0	98·4	98·0	98·5	98·8	98·0	97·9	98·1
16.	97·0	97·4	98·8	98·9	98·4	98·4	98·4	98·7	97·2	98·1
17.	97·2	97·7	98·6	98·7	98·5	98·5	98·4	98·4	97·6	98·2
18.	97·2	97·4	98·0	98·4	98·2	98·2	98·3	97·2	97·2	97·8
Mean of hours.	97·2	97·5	98·0	98·3	99·1	98·4	98·5	98·0	97·7	97·98

Date. March.	Hours. 6 A.M.	8 A.M.	10 A.M.	12 P.M.	2 P.M.	4 P.M.	6 P.M.	8 P.M.	10 P.M.	Mean of day.
Exercise on Water.										
19.	97·4	97·4	98·6	99·0	98·4	98·4	98·6	98·2	97·6	98·1
20.	97·0	97·5	97·8	97·6	97·4	98·0	98·8	98·2	97·8	97·7
21.	97·3	98·2	98·8	98·4	98·7	98·4	97·9	98·6	98·2	98·2
Mean of hours.	97·2	97·7	98·4	98·3	98·1	98·2	98·4	98·3	97·8	98·0
After exercise on Water.										
22.	97·6	98·2	97·6	98·4	98·8	98·4	98·4	98·4	97·2	98·1
23.	97·8	97·8	98·2	98·2	98·2	98·8	98·8	99·0	98·0	98·3
24.	97·4	97·6	98·2	98·8	98·6	98·6	98·8	97·6	97·6	98·2
Mean of hours.	97·6	97·8	98·0	98·5	98·5	98·6	98·7	98·3	97·6	98·2
Exercise on Brandy.										
25.	97·2	98·5	98·2	98·6	98·2	97·6	98·5	98·8	98·4	98·2
26.	97·3	98·2	98·4	98·0	98·0	98·2	98·0	98·0	98·2	98·0
27.	98·1	98·4	98·4	98·6	98·6	98·6	98·2	98·0	98·2	98·3
Mean of hours.	97·5	98·4	98·3	98·4	98·3	98·1	98·2	98·6	98·6	98·2
After exercise on Brandy.										
28.	98·2	98·5	98·2	98·2	98·0	98·6	98·4	98·0	97·8	98·2
29.	97·6	97·8	98·2	98·6	98·8	98·8	98·8	98·6	98·2	98·3
30.	98·2	98·2	...	...	...	...	...	...	...	...
Mean of hours.	98·0	98·1	98·2	98·4	98·4	98·7	98·6	98·3	98·0	98·25

The effect of exercise and water on the axilla temperature was imperceptible. The effect of exercise and brandy was also quite negative. The mean daily temperature, as obtained by observations every two hours, from 6 A.M. to 10 P.M., was 98° and 98°·2, or practically the same.

If the hours 12, 2, 4, 6, and 10, when the brandy was chiefly acting, are compared in the two periods, it appears quite certain that 12 fluid ounces (=341 cub. centims.) of brandy caused no diminution in temperature.

Mean Axillary Temperature.

	Hours.					
	12 noon.	2 P.M.	4 P.M.	6 P.M.	8 P.M.	10 P.M.
Exercise and water	98·3	98·1	98·2	98·4	98·3	97·8
Exercise and 4 ounces of brandy at 10, 2, and 6 o'clock	98·4	98·3	98·1	98·2	98·26	98·26

In three of the six hours the temperature was in excess in the water period and in three in the brandy period; but the differences between the two series are not greater than between the hours of successive days in any period, and are in opposite directions.

Temperature of Rectum.

First period.						
Date. March.	Hours. 6 A.M.	10 A.M.	2 P.M.	6 P.M.	10 P.M.	Mean of day.
13.	98·0	99·4	99·3	99·2	98·4	98·86
14.	98·0	99·0	99·2	99·2	98·6	98·8
15.	97·9	99·6	99·1	100·2	98·6	99·1
16.	97·8	99·5	99·3	99·4	98·9	98·98
17.	97·5	98·9	99·4	99·6	98·5	98·8
Mean of hours.	97·84	99·28	99·26	99·52	98·6	98·91
Exercise and brandy period.						
25.	98·6	99·2	99·15	99·3	99·2	99·1
26.	98·2	99·7	99·0	99·0	99·2	99·0
27.	98·6	99·0	99·0	99·4	99·2	99·0
Mean of hours.	98·4	99·3	99·05	99·2	99·2	99·0

The thermometer was inserted 4 inches into the rectum, and, unfortunately, gave rise to some irritation, viz. a feeling of pain and heaviness and the discharge of a little blood. We were obliged to discontinue the observations for several days, and can therefore only compare the first five days with the alcoholic period.

The comparison shows that alcohol causes no depression of the rectal temperature; there is even a slight elevation at 10 o'clock P.M., but as the reverse is the case at 6 o'clock P.M., no weight can be given to it. As

these results accord with the former experiments, it cannot, I think, be doubted that alcohol, in the amounts given in these trials, has no influence on the bodily temperature of healthy men.

6. *The elimination of Alcohol.*

As only qualitative experiments were made, it is not necessary to do more than state that before the brandy was given nothing could be found passing off by the skin, lungs, or kidneys which had the slightest reducing effect on Masing's bichromate-of-potassium test; while after the brandy a substance which at once reduced the test was passing off by all these channels, and especially by the skin, but the amount was not determined.

7. *The effect of Brandy on the work done.*

As the amount and kind of work done in the two exercise periods was nearly the same, I requested the man to observe as closely as he could whether he did the work better with or without the brandy. He commenced the exercise and brandy period with a belief that the brandy would enable him to perform the work more easily, but ended it with the opposite conviction. As already stated, the brandy was taken in 4-ounce doses at 10 A.M., 2 P.M., and 6 P.M., in an equal quantity of water, and the work was chiefly done in the two hours immediately succeeding each dose, and from 6 to 8 A.M.

The two hours' work from 10 A.M. to 12 noon, immediately after the first four fluid ounces of brandy, was, he thought, done equally well with and without the brandy. The man affirmed that he could tell no difference, except that, to use his own words, "the brandy seemed to give him a kind of spirit which made him think he could do a great deal of work; but when he came to do it, he found he was less capable than he thought."

After the second four ounces of brandy he felt hot and thirsty, but on the two first days he thought he worked as well as on the water days; on the third day, however, he had palpitation of the heart, and was surprised to find he was obliged to stop from time to time, because, to use his own words, "of his breathing not being so good."

The third four fluid ounces of brandy at 6 P.M. produced on all three days very marked narcotic effects. Immediately after taking it he became heavy, felt the greatest indisposition to exert himself, and could hardly refrain from throwing down his spade and giving up work. He worked with no vigour, and on the second evening thought his muscular power decidedly lessened. On the third evening, as it was raining, he could not dig, but took walking and running exercise under cover. On attempting to run, he found, to his great surprise, as he is a particularly fast and good runner, that he could not do so. He had palpitation and got out of breath, and was obliged to stop; so that he stated on the next day, "that if he had had his accoutrements on and been ordered to 'double,' he could not have obeyed the order."

After coming in from work on each evening he fell into a heavy sleep, from which he was roused with difficulty. This lasted for three or four hours, after which he was restless and sleepless.

The man's own judgment was, at the end of the trial, that he would prefer to do the work without the brandy; and when asked for his reasons, he mentioned "the increased thirst, the heaviness in the evening, and the fluttering at the heart."

His appetite was not affected.

Conclusions.

1. The elimination of nitrogen during exercise was unaffected by brandy; and since the experiments led to the same result in the former series during comparative rest, it seems certain that in healthy men on uniform good diet alcohol does not interfere with the disintegration of nitrogenous tissues.

2. The heat of the body, as judged of by the axilla and rectum temperatures, was unaffected by the amount given.

3. The pulse was increased in frequency by 4 ounces of brandy, and palpitation and breathlessness were brought on by larger doses, to such an extent as to greatly lessen the amount of work the man could do, and to render quick movements impossible. As the effect of labour alone is to augment the strength and frequency of the heart's action, it would appear obviously improper to act on the heart still more by alcohol. In this effect on the heart, and through it on the lungs, is perhaps to be found the explanation of the trainer's rule, which prohibits alcohol during exertion. Whether in a heart exhausted by exertion alcohol would be good or bad is not shown by these experiments; but it can hardly be supposed that to urge a heart which requires rest, as would then be the case, can be proper.

4. It seems clear, from the suddenness with which marked narcotic symptoms came on after the third dose was taken on each day, that the eight hours from 10 to 6 o'clock were not sufficient to get rid of the brandy taken at 10 and at 2, and that in fact the body must have been still saturated at 6 o'clock.

The exact amount of brandy which commenced to lessen the labour the man could perform is not shown by these observations, and would require more careful modes of investigation. It was evidently some quantity more than 4 ounces which produced effects sufficiently marked to attract his attention; but I should not wish to affirm that even 4 ounces produced no effect in this direction. The man himself was of opinion that 4 ounces had no influence either way. He was quite certain it did not aid his work, but he could not see that it injured it. The second 4 ounces decidedly produced a bad effect.

5. Neither exercise on water or on alcohol produced any effect on the phosphoric acid of the urine. The result is in accordance with that of the

experiments recorded in No. 89 of the 'Proceedings of the Royal Society' (vol. xv. p. 339).

The effect on the free acidity of the urine was inconsiderable. The free acidity may have been a little increased in the brandy period, but the change was slight.

The effect on the chlorine was not certain, as its ingress was not sufficiently constant, but it seems to be lessened in the exercise period.

As the action of alcohol in dietetic doses on the elimination of nitrogen and on the bodily temperature is so entirely negative, it seems reasonable to doubt if alcohol can have the depressing effect on the excretion of pulmonary carbon which is commonly attributed to it. It can hardly depress, one would think, the metamorphosis of tissues, or substances furnishing carbon, without affecting either the changes of the nitrogenous structures or bodily heat. It seems most important that fresh experiments should be made with respect to its effect on carbon elimination, as without a perfect knowledge on that point the use of alcohol as an article of diet in health cannot be fairly discussed.

IV. "Report on Scientific Researches carried on during the Months of August, September, and October, 1871, in H.M. Surveying-Ship 'Shearwater.'" By William Carpenter, LL.D., M.D., F.R.S. Received June 13, 1872.

[This paper will appear in full in a future Number of the 'Proceedings.']

June 20, 1872.

Sir JAMES PAGET, Bart., D.C.L., Vice-President, in the Chair.

Prof. William Grylls Adams, Dr. Andrew Leith Adams, Dr. John Cleland, Dr. Michael Foster, Prof. William Stanley Jevons, and Dr. William James Russell were admitted into the Society.

The following communications were read:—

I. "Preliminary Note on the Reproduction of Diffraction-gratings by means of Photography." By the Hon. J. W. Strutt, M.A. Communicated by Prof. G. G. Stokes, Sec. R. S. Received May 23, 1872.

During the last autumn and winter I was much engaged with experiments on the reproduction of gratings by means of photography, and met with a considerable degree of success. A severe illness has prevented my pursuing the subject for some months, and my results are in consequence still far from complete; but as I may not be able immediately to resume my experiments, I think it desirable to lay this preliminary note before the